

Claims:

1. A method for the thermal treatment of granular solids in a fluidized-bed reactor (1), in which microwave radiation from a microwave source (2) is fed into the reactor (1), **characterized in that** a first gas or gas mixture is introduced from below through at least one preferably central gas supply tube (3) into a mixing chamber (7) of the reactor, the gas supply tube (3) being at least partly surrounded by a stationary annular fluidized bed (8) which is fluidized by supplying fluidizing gas, and that the microwave radiation is supplied to the mixing chamber (7) through the same gas supply tube (3).
2. The method as claimed in claim 1, **characterized in that** the gas velocities of the first gas or gas mixture and of the fluidizing gas for the annular fluidized bed (8) are adjusted such that the Particle-Froude-Numbers in the gas supply tube (3) are between 1 and 100, in the annular fluidized bed (8) between 0.02 and 2, and in the mixing chamber (7) between 0.3 and 30.
3. The method as claimed in claim 1 or 2, **characterized in that** the Particle-Froude-Number in the gas supply tube (3) is between 1.15 and 20.
4. The method as claimed in any of the preceding claims, **characterized in that** the Particle-Froude-Number in the annular fluidized bed (8) is between 0.115 and 1.15.
5. The method as claimed in any of the preceding claims, **characterized in that** the Particle-Froude-Number in the mixing chamber (7) is between 0.37 and 3.7.
6. The method as claimed in any of the preceding claims, **characterized in that** the bed height of solids in the reactor (1) is adjusted such that the annular

fluidized bed (8) extends beyond the upper orifice end of the gas supply tube (3) and that solids are constantly introduced into the first gas or gas mixture and entrained by the gas stream to the mixing chamber (7) located above the orifice region of the gas supply tube (3).

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7. The method as claimed in any of the preceding claims, **characterized in that** the microwave radiation is introduced through a gas supply tube (3, 3a, 3b) constituting a wave guide (4, 4a, 4b) and/or through a wave guide (4a, 4b) arranged in the gas supply tube (3).

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8. The method as claimed in any of the preceding claims, **characterized in that** the microwave radiation is introduced through a plurality of wave guides (4a, 4b), each wave guide (4a, 4b) being provided with a separate microwave source (2a, 2b).

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9. The method as claimed in any of the preceding claims, **characterized in that** purge gas is passed through the wave guide (4, 4a, 4b).

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10. The method as claimed in any of the preceding claims, **characterized in that** the used frequency for the microwave source (2) lies between 300 MHz and 30 GHz, preferably between 400 MHz and 3 GHz, in particular at the ISM frequencies 435 MHz, 915 MHz and 2.45 GHz.

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11. The method as claimed in any of the preceding claims, **characterized in that** the cross-section and the dimensions of the wave guide (4) are adjusted to the used frequency of the microwave radiation.

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12. The method as claimed in any of the preceding claims, **characterized in that** the temperatures in the stationary annular fluidized bed (8) lie between 150°C and 1500°C.

13. The method as claimed in any of the preceding claims, **characterized in that** solids discharged from the reactor (1) and separated in a downstream separator (14) are at least partly recirculated to the annular fluidized bed (8) of the reactor.

14. The method as claimed in any of the preceding claims, **characterized in that** gas introduced through the wave guide (4) is used for an additional fluidization of the stationary fluidized bed (8).

15. The method as claimed in any of the preceding claims, **characterized in that** fined-grained solids with a grain size of less than 1 mm are supplied as starting material.

16. A plant for the thermal treatment of granular solids, in particular for performing a method as claimed in any of claims 1 to 15, comprising a reactor (1) constituting a fluidized-bed reactor and a microwave source (2), **characterized in that** the reactor (1) includes a gas supply system which is formed such that gas flowing through the gas supply system entrains solids from a stationary annular fluidized bed (8), which at least partly surrounds the gas supply system, into the mixing chamber (7), and that microwave radiation can be introduced by the gas supply system.

17. The plant as claimed in claim 16, **characterized in that** the gas supply system includes a gas supply tube (3) extending upwards substantially vertically from the lower region of the reactor (1) into the mixing chamber (7) of the reactor (1), the gas supply tube (3) being surrounded by a chamber which at least partly extends around the gas supply tube (3) and in which the stationary annular fluidized bed (8) is formed.

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18. The plant as claimed in claim 17, **characterized in that** the gas supply tube (3) is arranged approximately centrally with reference to the cross-sectional area of the reactor (1).

5 19. The plant as claimed in any of claims 16 to 18, **characterized in that** the gas supply tube (3) constitutes a wave guide (4) for introducing the microwave radiation.

10 20. The plant as claimed in any of claims 16 to 19, **characterized in that** in the gas supply tube (3) at least one wave guide (4a, 4b) is arranged for introducing the microwave radiation.

15 21. The plant as claimed in any of claims 16 to 20, **characterized in that** a plurality of gas supply tubes (3a, 3b) and/or a plurality of wave guides (4a, 4b) are provided, a separate microwave source (2a, 2b) being connected to each wave guide (4a, 4b).

20 22. The plant as claimed in any of claims 19 to 21, **characterized in that** a wave guide (4) has a rectangular or round cross-section.

23. The plant as claimed in any of claims 19 to 22, **characterized in that** a wave guide (4) has a length of 0.1 m to 10 m.